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(54) A METHOD OF BONDING A HEAT SINK TO A PRINTED CIRCUIT BOARD

(71) We, THE PLESSEY COMPANY LIMITED, a British Company of Vicarage Lane, Ilford, Essex, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to a method of bonding a heat sink to a printed circuit board.

Printed circuit boards are well known. During operation of the printed circuit boards, heat is usually generated and this heat can sometimes become so great that it prevents the printed circuit board operating correctly or, alternatively, reduces the life of the printed circuit board components. In order to dissipate the heat generated by the printed circuit board, it is known to bond a heat sink, for example a metal plate, to be printed circuit board.

The heat sinks have to be provided with a plurality of apertures in order to allow various electrical connections to be made to the printed circuits. Hitherto, the heat sinks have been stuck to the printed circuit boards by first applying and adhesive in the form of a solid sheet over the whole of the printed circuit board and then cutting out the adhesive in the pattern of the holes. This operation is time consuming and, since the holes in various heat sinks often differ in position from each other, it is difficult to standardize the process. After the sheet has been cut, the heat sink is then bonded to the printed circuit board using heat and a relatively high degree of pressure.

It is an aim of the present invention to provide a method of bonding a heat sink to a printed circuit board which does not involve the cutting of a solid sheet of adhesive, and which also does not involve the use of elevated temperature and high pressures.

Accordingly, the present invention provides a method of cold bonding a heat sink on to a printed circuit board, which method comprises coating the heat sink with a room temperature curing silicon-containing adhesive, and then bringing the printed circuit board and the heat sink together under sufficient pressure to ensure that the printed circuit board and the heat sink are in contact and for a period of time until curing has taken place.

Preferably, the adhesive is sprayed on to the heat sink to form a coating of the required thickness. Since the adhesive is sprayed, it does not form over the various holes in the heat sink. In order to spray the adhesive, it may be necessary to dilute the adhesive and various solvents can be used such for example as trichloroethane.

As an alternative to spraying, the adhesive can be brushed or silk screened on to the heat sink. When a silk screen is employed, a relatively slow curing adhesive is preferred, since otherwise the adhesive may cure too quickly and may tend to clog the silk screen.

The amount of adhesive on the heat sink should be such that there is insufficient adhesive to flow into the apertures when the bonding takes place. There should however be sufficient adhesive to give good bonding and insulation, and to get around the sides of the track.

Usually, the heat sinks will be sprayed and then substantially directly contacted with a printed circuit board. However, if desired, a sprayed or otherwise coated heat sink can be allowed to cure and can then be stored. When it is desired to contact the heat sink with a printed circuit board, then the heat sink can be given a further light adhesive coating.

The adhesive is preferably a silastomer, i.e. a silicon containing elastomer. A presently preferred silastomer is that sold by Dow Corning under their trade mark SILASTIC 732. This silastomer is a rubber material which allows the printed circuit boards and their heat plates to expand by slightly different amounts without buckling the resulting assembly.

The heat sinks are preferably metal plates, for example anodized aluminium or copper plates.

The pressure may be applied to the printed circuit board merely by applying a weight on top of the printed circuit board and the heat sink. Alternatively, the pressure can be ap-

plied by means of vacuum. Excess pressure should be avoided since it may squash the adhesive into the apertures.

The printed circuit boards can be such that they have tracks on one or both sides. Also, the method of the invention can be such that several sets, e.g. up to ten or more, of the combined circuit boards and heat sinks are adhered together in one operation. The various sets of the printed circuit boards and heat sinks can be separated from each other by separator means, such for example as a sheet of paper, to avoid the various sets adhering together.

An embodiment of the invention will now be described solely by way of example and with reference to the accompanying drawing which is an exploded view of the printed circuit boards as they are being provided with the heat sinks.

Referring to the drawing, there is shown a jig 2 having upstanding jig members 4. On the jig 2 and over the members 4 is respectively provided a paper layer 6, a printed circuit board 8, a heat sink 10, a paper layer 12, a printed circuit board 14 and a heat sink 16. The paper layers, the printed circuit boards and the heat sinks are apertured as shown to go over the members 4.

The heat sinks 10, 16 are coated with the aforementioned SILASTIC 732 which is sprayed on to the heat sinks 10, 16 from a solvent solution to form adhesive layers 10A, 16A respectively. The assembly is gently pressed together by means of a weight in the form of a plate 18 which rests on top of the heat sink 16 and locates over the upstanding members 20 formed on a base plate 22. Usually, it will be necessary to leave the assembly for about 48 hours at room temperature before the curing is complete. If necessary, the assembly can be left for a further period, for example 24 hours.

It is to be appreciated that the embodiment of the invention described above has been given by way of example and that modifications may be effected. Thus, for example, the adhesive could be brushed on. It should also be appreciated that the drawing is schematic and the electrical circuit on the boards and the apertures in the heat sinks have not been shown. The SILASTIC 732 is a one part adhesive but two part room temperature curing silicon-containing adhesives (i.e. adhesives requiring two ingredients to be mixed together for curing) can be employed.

WHAT WE CLAIM IS:—

1. A method of cold bonding a heat sink on to a printed circuit board, which method comprises coating the heat sink with a room temperature curing silicon-containing adhesive, and then bringing the printed circuit board and the heat sink together under sufficient pressure to ensure that the printed circuit board and the heat sink are in contact and for a period of time until curing has taken place.

2. A method as claimed in claim 1 in which the adhesive is sprayed on to the heat sink to form a coating of the required thickness.

3. A method as claimed in claim 2 in which the adhesive is diluted with a solvent.

4. A method as claimed in claim 1 in which the adhesive is brushed or silk screened on to the heat sink.

5. A method as claimed in any one of claims 1 to 3 in which the heat sink is sprayed and then substantially directly contacted with a printed circuit board.

6. A method as claimed in any one of the preceding claims in which the adhesive is a silastomer.

7. A method as claimed in any one of the preceding claims in which the heat sink is a metal plate.

8. A method as claimed in claim 7 in which the metal plate is an aluminium or copper plate.

9. A method as claimed in any one of the preceding claims in which several sets of the combined circuit boards and heat sinks are adhered together in one operation.

10. A method of cold bonding a heat sink on to a printed circuit board, substantially as herein described with reference to the accompanying drawing.

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For the Applicants.

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1594834 COMPLETE SPECIFICATION

1 SHEET *This drawing is a reproduction of the Original on a reduced scale*